PATENT COOPERATION TREATY
INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

(Chapter II of the Patent Cooperation Treaty)

(PCT Article 36 and PCT Rule 70)

Applicant's or agent's file reference: 16-284	See Form PCT/IPEA/416 for further action.	
International application No. PCT/JP2004/014630	International filing date (day/month/year) 05. 10. 2004	Priority date (day/month/year) 08. 10. 2003
International Patent Classification (IPC) or national classification and IPC Int. Cl. F02M61/18 (2006. 01)		
Applicant KEIHIN CORPORATION		

1. This report is the international preliminary examination report, established by this International Preliminary Examining Authority under Article 35 and transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets including this cover sheet.
3. This report is also accompanied by ANNEXES, comprising
   a. ☒ a total of 1 sheet, as follows:
      ☒ sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications authorized by this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions).
      ☐ sheets which supersede earlier sheets, but which this Authority considers contain an amendment that goes beyond the disclosure in the international application as filed, as indicated in item 4 of Box No.I and the Supplemental Box.
   b. ☐ a total of (indicate type and number of electronic carrier(s)) _____, containing a sequence listing and/or tables related thereto, in computer readable form only, as indicated in the Supplemental Box Relating to Sequence Listing (see Section 802 of the Administrative Instructions).

4. This report contains indications relating to the following items:
   - ☒ Box No. I Basis of the report
   - ☐ Box No. II Priority
   - ☐ Box No. III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
   - ☐ Box No. IV Lack of unity of the invention
   - ☒ Box No. V Reasoned statement under PCT Article 35(2) with regard to novelty, inventive step or industrial applicability: citations and explanations supporting such statement
   - ☐ Box No. VI Certain documents cited
   - ☐ Box No. VII Certain defects in the international application
   - ☐ Box No. VIII Certain observations on the international application

Date of submission of the demand 28. 04. 2005	Date of completion of this report 16. 01. 2006
Name and mailing address of the IPEA/JP Facsimile No.	Authorized officer Telephone No.

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/JP2004/014630

I. Basis of the report

1. With regard to the language, this report is based on the following language.
   ☒ the language in which the international application was filed.
   ☐ This report is based on translations from the original language into the following language _____, which is language of a translation furnished for the purpose of:
   - ☐ international search (under Rules 12.3 and 23.1(b))
   - ☐ publication of the international application (under Rule 12.4).
   - ☐ international preliminary examination (under Rules 55.2 and/or 55.3).

2. With regard to the elements of the international application, this report is based on (replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report):

   ☐ The international application as originally filed/furnished

   ☒ the description:

   pages 1 to 9 (1 to 11 in the English version), as originally filed/furnished
   pages* _____, received by this Authority on _____
   pages* _____, received by this Authority on

   ☒ the claims:

   Nos. _____, as originally filed/furnished
   Nos.* 1, 3 to 7, as amended (together with any statement) under Article 19
   Nos.* _____, received by this Authority on _____
   Nos.* _____, received by this Authority on

   ☒ the drawings:

   ~~pages~~/Figs. 1 to 5, as originally filed/furnished
   pages/Figs.* _____, received by this Authority on
   pages/Figs.* _____, received by this Authority on

   ☐ a sequence listing and/or any related table(s) - see Supplemental Box Relating to Sequence Listing.

3. ☒ The amendments have resulted in the cancellation of:
   - ☐ the description, pages _____
   - ☒ the claims, No. 2
   - ☐ the drawings, sheets/fig _____
   - ☐ the sequence listing (specify):_____
   - ☐ any table(s) related to sequence listing (specify):_____

4. ☐ This report has been established as if (some of) the amendments annexed to this report and listed below had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)
   - ☐ the description, pages _____
   - ☐ the claims, Nos. _____
   - ☐ the drawings, sheets/fig _____
   - ☐ the sequence listing (specify):_____
   - ☐ any table(s) related to sequence listing (specify):_____

* If item 4 applies, some or all of those sheets may be marked "superseded."

INTERNATIONAL PRELIMINARY REPORT ON PATENTABILITY

International application No.
PCT/JP2004/014630

Box No. V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement

1. Statement

Novelty (N)	Claims 1 and 3 to 7	Yes
	Claims	No
Inventive step (IS)	Claims	Yes
	Claims 1 and 3 to 7	No
Industrial applicability (IA)	Claims 1 and 3 to 7	Yes
	Claim	No

2. Citations and explanations (PCT Rule 70.7)

Document 1: JP 2003-206828 A (Visteon Global Technologies, Inc.)
25 July, 2003, Full text; all drawings
& US 2003/0127540 A1, Full text, all drawings

Document 2: JP 2003-13824 A (Siemens VDO Automotive Corp.)
15 January, 2003, Full text; all drawings
& US 6513724 B1, Full text; all drawings

Document 3: JP 2002-130082 A (Keihin Corp.)
09 May, 2002, Figs. 5 and 6
& US 2002/0063175 A1, Figs. 5 and 6

Document 4: JP 2002-130074 A (Keihin Corp.)
09 May, 2002, Figs. 4 and 6
& US 2002/0063174 A1, Figs. 4 and 6

Document 5: JP 2003-155965 A (Mitsubishi Electric Corp.)
30 May, 2003, Full text; all drawings

Document 6: JP 2003-148299 A (Hitachi, Ltd.)
21 May, 2003, Full text; all drawings

Document 7: JP 2002-4983 A (Siemens Automotive Corp.)
09 January, 2002, Par. No. [0025]; Fig.4
& EP 1154151 A1, Par. No. [0025]; Fig.4

The invention according to Claim 1 does not appear to have inventive step in view of Document 1 or 2 cited in the ISR. Document 1 (see Figs. 1 to 3 and 7) or Document 2 (see Fig.1) describes the arrangement that the length of a valve seat hole is sufficiently larger than the height of a fuel diffusion chamber. Further, a special critical meaning cannot be found in that the length of the valve seat hole is defined to be equal to or more than two times as large as the height of the fuel diffusion chamber, and this feature appears to be a matter that can be set up by a person skilled in the art as desired. It also appears to be a matter that can be set up by a person skilled in the art as desired considering the fuel spray amount and fuel spray characteristic as to

Supplemental Box

(Use this Box if, in any of the Boxes, the space is insufficient to furnish all the information.)
Continuation of Box No. V 2.

how much the height of the fuel diffusion chamber should be set specifically.

The invention according to Claim 3 does not appear to have inventive step in view of Document 1 or 2 and Document 3 or 4 cited in the ISR. It appears to be easy for a person skilled in the art to employ the arrangement of Document 3 (see Figs. 5 and 6) or 4 (see Figs. 4 and 6) in a fuel injection valve disclosed in Document 1 or 2 that an angled section between the valve seat hole and the fuel diffusion chamber is given a chamfer.

The invention according to Claim 4 does not appear to have inventive step in view of Document 1 or 2 and Document 5, 6 or 7 cited in the ISR. It appears to be easy for a person skilled in the art to employ the arrangement of Documents 5, 6 or 7 in the fuel injection valve disclosed in Document 1 or 2 that the fuel diffusion chamber is formed so that the height thereof decreases when going in a radially outward direction.

The invention according to Claim 5 does not appear to have inventive step in view of Documents 1 to 6. It appears that there are no special difficulties in adding to the fuel injection valve disclosed in Document 1 or 2 the arrangement of Document 3 (see Figs. 5 and 6) or 4 (see Figs. 4 and 6) that an angled section between the valve seat hole and the fuel diffusion chamber is given a chamfer and the arrangement of Document 5 (see Figs. 5 and 6) or 6 (see Figs. 7 and 9) that an annular step is provided in the upper face of the fuel diffusion chamber.

The invention according to Claims 6 and 7 does not appear to have inventive step in view of Documents 1 to 5. It appears that there are no difficulties in particular in adding to the fuel injection valve disclosed in Document 1 or 2 the arrangement of Document 3 (see Figs. 5 and 6) or 4 (see Figs. 4 and 6) that an angled section between the valve seat hole and the fuel diffusion chamber is given a chamfer and the arrangement of Document 5 (see Figs. 5 and 6) that an annular step is provided in the upper face of the fuel diffusion chamber.

In the meantime, it can appropriately be employed by a person skilled in the art considering lubricant flow of the fuel to form an annular step so as to have a tapered or an arcuate section.

[1] (amended) A fuel injection valve comprising a valve assembly (14) having a valve portion (16); a valve seat member (3) having provided therein a conical valve seat (8) and a valve seat hole (7), the valve seat (8) cooperating with the valve portion (16), and the valve seat hole (7) communicating with the downstream end of the valve seat (8); an injector plate (10), the injector plate (10) being joined to the valve seat member (3); a radially extending and flat fuel diffusion chamber (43), the fuel diffusion chamber (43) being formed between the valve seat member (3) and the injector plate (10), and the downstream end of the valve seat hole (7) opening in a central part of the fuel diffusion chamber (43); and a plurality of fuel injection holes (11), the fuel injection holes (11) being bored in the injector plate (10) so as to open in the fuel diffusion chamber (43);

characterized in that the fuel injection holes (11) are arranged so as to be radially outwardly separated from the valve seat hole (7), and when the height of the fuel diffusion chamber (43) is t1 and the length of the valve seat hole (7) is t2, $t2/t1 \geq 2$, and further, the height of a section of the fuel diffusion chamber (43) that the fuel injection holes (11) face is 20 to 110 μm.

[2] (deleted)

[3] (amended) The fuel injection valve according to Claim 1,

wherein an angled section between the valve seat hole (7) and the fuel diffusion chamber (43) is given a chamfer (45).

[4] (amended) The fuel injection valve according to either Claim 1 or 3,

wherein the fuel diffusion chamber (43) is formed so that the height thereof decreases when going in a radially outward direction.

[5] (added) The fuel injection valve according to Claim 3,

wherein at least one annular step (43b) is provided between the chamfer (45) and a lower end of the valve seat hole (7) communicating with the fuel diffusion chamber (43).

[6] (added) The fuel injection valve according to Claim 5,

wherein the annular step (43b) is formed so as to have a tapered section.

[7] (added) The fuel injection valve according to Claim 5,

wherein the annular step (43b) is formed so as to have an arcuate section.